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CLEANING SPARK PLUGS

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4 Claims. (Cl. 134—30)

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My invention relates to cleaning spark plugs used in spark ignition engines and contemplates the removal of deposits of fuel ignition products and the like which coat and leave small beady deposits on the electrodes and ceramic bases of the plugs, causing faulty ignition.

In particular, my invention is useful in cleaning spark plugs used in spark ignition engines employing gasoline fuels containing lead compounds and other additives which improve the octane rating of the fuel. Such deposits are commonly found on spark plugs removed from aircraft and automotive vehicle engines, and generally result in faulty and inefficient fuel ignition long before the spark plug electrodes are rendered inefficient due to spark erosion.

Spark plug deposits are predominately lead oxide and lead bromide or lead oxybromide. In order to ascertain the chemical nature of such deposits, the accumulation of picking and scraping deposits from electrodes of a large number of aircraft plugs in a commercial airlines, engine overhaul base were sampled and analyzed as follows:

	X-ray diffraction	Emission spectrograph	Chemical analysis, percent
Lead oxide	Present		
Lead bromide	do		
Lead		Major	62.5
Bromine			22.5
Silica		Minor	3.8
Iron	Present	do	2.4
Sulfur			0.3
Chromium		Minor	0.05
Oxygen (by difference)			8.4

I have discovered that ammonium citrate in equeous solution has a solvent action on spark plug deposits which permits the removal of the deposits and leaves the electrodes in substantially clean condition. More precisely, my invention is a method for the removal of such deposits by subjecting them to the solvent action of a hot aqueous ammonium citrate solution, preferably

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at temperatures above about 150° F. and most usefully at boiling temperatures. I prefer to use concentrations of ammonium citrate within the range of 10 to 20% by weight; however, there is nothing critical in such concentration, since 5% may be used with somewhat slower results. Higher concentrations are permissible within the solubility limits of the salt. Generally the time of contact of the solution with plug will be within the range of 10 to 20 minutes, but the time, of course, varies with the temperature and concentration of the solution as well as with the degree of deposition on the plug.

My preferred procedure is first to remove any coating of oil or grease from the plug, such as by a solvent rinse or with a vapor bath degreaser, in order to permit the cleaning solution to come directly into contact with the deposits. The spark plug is then contacted for a period of about 10 to 20 minutes or more with a boiling solution of 10 to 20% of ammonium citrate in water. This treatment dissolves the overall deposit layer from the plugs and at least loosens any beady deposits so that they may be easily picked off and removed. It is desirable that the clean plug should be washed with clean water and then dried so as to prevent rusting.

I have found that my ammonium citrate treatment may etch the metal outside surface of the spark plug very lightly. Usually this is not objectionable, but where it is, the outside of the plug may readily be protected by employing a water-tight rubber sleeve which covers the threaded surfaces and other outside metal fittings, but which leaves the electrode end of the plug exposed. Alternatively, a bath may be employed which is constructed with threaded openings to fit the plugs so that only the electrode ends are in contact with the ammonium citrate cleaning solution.

As illustrative of the action of my process on typical spark plugs having varying amounts of deposits, three spark plugs were treated with the following results:

	Plug A	Plug B	Plug C
Condition before treatment:			
Ceramic core	Brown deposit (100% coverage) 2 brown beads near tip.	Purple deposit (75% coverage) No beads.	Gray deposit (50% coverage) 1 metallic bead.
Electrodes	Black deposit (100% coverage)	Black deposit (100% coverage)	Gray deposit (100% coverage).
Treatment	Immersed 10 minutes in 10% boiling ammonium citrate.	Treated 3 minutes in 10% boiling ammonium citrate.	Treated 20 minutes in 20% boiling ammonium citrate.
Condition after treatment:			
Ceramic core	Deposit removed, beads easily picked off.	Removed all but one small spot of yellow deposit.	Only scattered red spots remain, metallic deposit easily picked off.
Electrodes	Clean	Clean	Clean.
Outside metal surface	Lightly etched	Not affected	Not affected.

In the above examples plug A was unprotected in any way while plugs B and C were fitted with a tight rubber sleeve over their outer metal surfaces as previously described. The process employed in each case was substantially as outlined above, employing first a degreasing operation, then the ammonium citrate cleaning treatment followed by water washing and lastly by drying.

I claim:

1. A process for cleaning engine spark plugs to remove deposits consisting essentially of lead oxide, lead oxybromide, and lead bromide which comprises removing grease and oil from the electrode surfaces of the plug, thereafter subjecting the electrode surfaces of the plug to the solvent action of a hot aqueous solution of ammonium citrate, washing the cleaned plugs with water, and drying the plugs.

2. In a process for cleaning engine spark plugs to remove deposits consisting essentially of lead oxide, lead oxybromide, and lead bromide, a step which comprises subjecting the electrode surfaces of the plugs free from grease and oil to the solvent action of a hot aqueous solution of ammonium citrate.

3. A process of cleaning engine spark plugs to remove deposits consisting essentially of lead oxide, lead oxybromide, and lead bromide according to claim 1, in which the aqueous solution of ammonium citrate contains 10–20% by weight of ammonium citrate.

4. A process of cleaning engine spark plugs to remove deposits consisting essentially of lead oxide, lead oxybromide, and lead bromide according to claim 1, in which the aqueous solution of ammonium citrate is contacted with the plug at temperatures above about 150° F.

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